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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF

:

#19

RICARDO COZAR, ET AL.

: EXAMINER: IP, S.

SERIAL NO: 09/940,481

:

FILED: AUGUST 29, 2001

: GROUP ART UNIT: 1742

FOR: FE-CO-NI ALLOY AND USE FOR  
THE MANUFACTURE OF A SHADOW  
MASK

:

APPEAL BRIEF

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

Responsive to the final rejection of the Office Action of September 23, 2002 and the Interview Summary of November 19, 2002, Applicants hereby appeal the rejections of Claims 1-18.

I. Real Party in Interest

The Real Party of Interest is Imphy S.A. located in Puteaux, France, by virtue of the assignment recorded in the U.S. Patent and Trademark Office on July 25, 1996 at Reel 8005/Frame 0626.

II. Related Appeals and Interferences

The presently appealed application is a Continuation application of U.S. Application Serial No. 08/641,233 filed on April 30, 1996, now abandoned. An Appeal Brief was filed with the Office on October 8, 1997 in the parent application. A Decision on Appeal was mailed on June 29, 2001, affirming the Examiner's rejections in the parent case. Copies of the Appeal Brief, Examiner's Answer, Reply Brief and Decision on Appeal are provided in Appendix I.

III. Status of the Claims

Claims 1-18 are pending and are appealed.

IV. Status of Amendments Filed Under 37 C.F.R. § 1.116

The Amendment and Request for Reconsideration filed with the U.S. Patent and Trademark Office on July 8, 2002, has been entered and considered.

V. Summary of the Invention

The presently claimed invention is drawn to an alloy composition that contains elements including Ni, Co, Mn, Si, Cr, C, S, Ca and Mg (Claims 1-6 and 9-15); a shadow mask containing the alloy (Claims 7 and 16-17); and a method of forming a shadow mask containing the alloy (Claims 8 and 18). The relative amounts of Co and Ni in the claimed

alloy are related to one another by three formulae and must remain within the boundaries recited in the formulas of independent Claims 1, 7, 8, 9, 16 and 18.

Applicants have discovered that local doming which may occur in shadow masks exposed to thermal stress can be reduced if the alloy from which the shadow mask is made adheres to the compositional and/or physical property requirements of the claimed invention (page 3, lines 20-26 and page 7, lines 7-14).

The claimed alloy compositions advantageously have a low martensitic transformation start point ( $M_s$ ). A low martensitic start point is advantageous because the alloy undergoes a structure change (e.g., from austenitic to martensitic) upon crossing this threshold temperature barrier (paragraph bridging pages 3 and 4). The present alloy composition is therefore advantageous in applications where shadow masks or other articles must be transported through or stored in cold environments such as those that they exist in cold weather regions such as Canada and Siberia. The claimed alloy compositions have low martensitic transformation start points (less than  $-50^{\circ}\text{C}$  for independent Claims 1, 7 and 8 and less than  $-186^{\circ}\text{C}$  for independent Claims 9, 16 and 18).

The average and mean coefficients of thermal expansion of the claimed alloy compositions are related to the austenitic and martensitic composition of the alloy (page 4, last paragraph through page 5, line 9). Since the coefficient of thermal expansion of the austenitic and martensitic structures may differ, the overall coefficient of thermal expansion of the alloy composition is a weighted average of the coefficient of thermal expansion of both the austenitic and martensitic structures. An austenitic structure (i.e., an alloy that has not passed through the martensitic transformation start point) exhibits a low coefficient of thermal expansion. The average coefficient of thermal expansion of the claimed alloy must lie between the values recited in the independent claims. The alloy compositions of the independent claims overcome some of the distortion and doming problems associated with

prior art iron based alloys (page 2, line 4 through page 3, line 18 and page 3, line 23 through page 4, line 16).

VI. Issues

A. Whether Claims 1-18 are obvious within the meaning of 35 U.S.C. § 103 in view of patents to Inoue (U.S. 5,234,512), Fukuda (U.S. 5,236,522), Ishikawa (U.S. 4,832,908) or Kato (U.S. 5,164,021).

B. Whether Claims 1-18 contain subject matter which was described in the specification in such a way as to enable one skilled in the art to make and/or use the invention within the meaning of 35 U.S.C. § 112, first paragraph.

C. Whether Claims 1, 7 and 8 are indefinite within the meaning of 35 U.S.C. § 112, second paragraph for reciting two coefficients of thermal expansion.

VII. Grouping of Claims

Claims 1-18 do not stand or fall together. The claims are grouped individually and, for each ground of rejection appealed herein which applies to a group of two or more claims, the group of claims do not stand or fall together. In the arguments below individual grounds for the patentability of each claim are provided.

VIII. Arguments

A. The unobviousness of claims 1-18 in view of Inoue (U.S. 5,234,512), Fukuda (U.S. 5,236,522), Ishikawa (U.S. 4,832,908) and/or Kato (U.S. 5,164,021).

Independent Claims 1, 7 and 8 require that the alloy have a martensitic transformation start point of less than -50°C and an average coefficient of thermal expansion measured between 20°C and 100°C of  $\leq 0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion

measured between 80°C and 130°C of  $\leq 1 \times 10^{-6}/^{\circ}\text{K}$ . Independent Claims 1 and 7-8 also limit the amount of cobalt and nickel present in the alloy and their interrelationship. Other elements including manganese are also limited.

One of the prior art references (Fukuda) cited by the Office in the rejection of independent Claims 1 and 7-8 as obvious states with regards to the Mn content: “[a]ny content below 0.1% would assure no appreciable improvement in forging adaptability” (column 2, lines 58-65). Therefore, the Fukuda reference states that alloys containing less than 0.1% Mn are not desirable and would not provide the physical characteristics desired of the alloy or articles derived from the alloy. In the presently claimed invention the Mn content is limited to  $\leq 0.1\%$ . It is disclosed in the present specification that: “...in order for the mean coefficient of expansion between 20° and 100°C to be less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$ , it is preferable for each of the manganese, silicon and chromium contents to be less than or equal to 0.1%” (page 5, lines 5-9). Thus it is presently disclosed that an Mn content of less than 0.1% is an important determinant of the coefficient of expansion. In contrast, Fukuda discloses that the amount of Mn required in the prior art invention is greater than the amount allowable in the presently claimed alloy. Fukuda states that this Mn level is necessary to obtain an alloy composition having the desired physical properties.

Combining the disclosure of the Fukuda reference with the other references relied upon by the Office to render the presently claimed invention obvious makes no sense in view of the fact that Fukuda teaches that at least one element of the presently claimed alloy composition must be present in an amount greater than that allowed by the present independent claims. Similarly, the Kato patent permits Mn to be present at a concentration of  $< 1\%$  while Ishikawa allows Mn to be present at a concentration of 0.005 to 0.70%.

An Mn content of less than 0.1% is nowhere disclosed in the Examples of the Fukuda patent. In each of the Examples presented in Tables 1, 3 and 5 of Kato nowhere is a Mn

concentration provided which is within the presently claimed range. Although Kato recognizes that Mn may impair an initial low thermal expansion, the reference does not recognize the importance of maintaining Mn at a level below 0.1% as presently claimed. Even if this disclosure were to suggest levels of Mn below 0.1%, when considered as a whole, the prior art reference teaches those of ordinary skill in the art that alloy compositions having amounts of Mn that are greater than that is allowed in the present claims are favored.

Ishikawa discloses a single example (Test Piece No. 35 in Table 1) having an Mn content of less than 0.1%. However this example has a silicon content outside the presently claimed range (0.17% vs. 0.1% max).

Therefore, based upon the maximum amount of Mn allowed in the present alloy composition, the prior art references relied upon by the Office teach away from the claimed composition and instead favor compositions wherein the amount of Mn is greater than the maximum amount allowed by the present independent claims.

At least the Fukuda reference is therefore not fairly applied to the present claims as pertinent prior art as evidenced by the contradictory teachings of the reference. At least this reference should therefore be withdrawn and any rejection in view of the patent should be reversed.

The Office has indicated that the difference between the Inoue reference and the present claims includes Inoue's failure to contain Co (see paragraph 12 of the Office action of September 9, 2002). Cobalt is a required element of the presently claimed alloy composition. Its absence in the claimed alloy would provide an alloy which does not meet the present claim limitations with regard to the compositional or performance (i.e., physical properties) requirements. The rejection of the present claims, wherein Co is required to be present, in view of a reference in which Co is not identified as a necessary or critical element makes no sense. In order for those of ordinary skill in the art to duplicate or be led to the presently

claimed invention from the disclosure of Inoue the reference must provide a competent teaching towards the inclusion of Co in order to achieve improved alloy performance.

Further, Inoue provides no disclosure that an interrelationship between Co and Ni elements is necessary in order to achieve an alloy composition which is able to provide the martensitic transformation start point and thermal expansion coefficient performance of the presently claimed compositions. For these reasons the rejection of the claims in view of the Inoue patent should be withdrawn and the rejections in view of the Inoue patent reversed.

None of Inoue, Ishikawa or Kato disclose compositions which adhere to all of the present claim limitations or overlap with the range of each claimed element. Inoue does not require the inclusion of cobalt, a necessary element of the presently claimed compositions. Ishikawa requires a greater amount of carbon than is allowed in the present claims (0.02% max vs. 0.2% min (see Abstract of Ishikawa)). Kato permits Mn at a concentration that is greater than that of the maximum concentration allowed herein (0.1% max vs. 1% max).

Each of the Inoue, Ishikawa and Kato patents fails to recognize the importance of one or more of the ranges limited in the claimed alloy composition. The Office has selected teachings from one or more of the prior art reference cited by the Office to render the presently claimed invention obvious. However, this selection was accomplished with the benefit of hindsight using Applicants' claimed invention as a template for assembling a prima facie case of obviousness. The Office has collected a series of references (which each individually suffer from a severe deficiency with regards to the presently claimed composition) then assembled the necessary element ranges to render the claimed invention obvious. Such hindsight examination is an improper basis from which to determine obviousness. If the Office takes the position that the Examiner is obligated only to take into account that knowledge which was within the level of ordinary skill at the time the claimed invention was made in order to render the invention obvious, it begs the question why the

presently claimed invention was not earlier claimed or disclosed in one or more of the prior art references and further why the prior art references contain disclosure which specifically avoids and teaches away from the presently claimed alloy.

With regards to independent Claims 9, 16 and 18, the martensitic transformation start point is limited to less than  $-186^{\circ}\text{C}$  and the thermal coefficient of expansion between  $20^{\circ}\text{C}$  to  $100^{\circ}\text{C}$  is limited to from  $0.49 \times 10^{-6}$  to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and the compositions are further limited by the transitional phrase “consisting essentially of” which excludes elements whose presence would otherwise materially effect the basic and novel characteristics of the claimed invention. Such a composition is not disclosed or suggested by the prior art references. In fact, in one of the prior art references which discloses thermal expansion properties (Fukuda) it is disclosed that the prior art compositions have a thermal coefficient of expansion that is preferably less than  $0.49 \times 10^{-6}$ . The patent also discloses compositions having a thermal coefficient of expansion greater than the upper limit presently claimed of  $0.7 \times 10^{-6}$  but does not disclose the presently claimed range.

For the reasons given above, the rejections of independent Claim 9, 16 and 18 should be withdrawn and the rejections reversed.

The Office appears to be asserting that the compositions of one or more of the prior art references would inherently have the martensitic transformation start point and/or thermal coefficient of expansion properties of the presently claimed invention (independent Claims 9, 16 and 18). Applicants have provided an example in the specification as originally filed (Sample A) which has a composition which meets the requirements of Ni, Co, Mn and Si content of Ishikawa and Ni, Co, Si and C content of Fukuda. The martensitic transformation start point of this material is only  $-90^{\circ}\text{C}$  which is greater than the less than  $-186^{\circ}\text{C}$  required in Claims 9, 16 and 18. Even though the Sample A composition falls within at least some of the compositional requirements of the prior art references, it is unable to provide the martensitic



transformation start point performance of present Claims 9, 16 and 18. Therefore, the martensitic transformation start point of less than  $-186^{\circ}\text{C}$  recited in independent Claims 9, 16 and 18 is not a property inherent to the Ishikawa or Fukuda compositions.

There is no disclosure in any of the prior art references cited by the Office that the presently claimed thermal coefficient of expansion properties and martensitic transformation start points are inherent to the prior art compositions or are achievable when the cobalt and nickel interrelationships meet the present claim limitations and the other elements are present in the presently claimed quantities. For the reasons given above, the rejections of independent Claims 9, 16 and 18 should be reversed.

Dependent Claims 10 and 17 limit the average coefficient of thermal expansion of the composition of Claims 9 and 17 respectively to an even narrower level (from  $0.65 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ ). None of the prior art compositions are disclosed to have an average coefficient of thermal expansion within the range claimed in dependent Claims 9 and 17. Since the prior art applied by the Office does not disclose the limitations of present Claims 9 and 17 the claims should not be obvious in view of the applied art and the rejections should be reversed.

Dependent Claims 2 and 11 further limit the claimed composition by limiting the amount of Cu, Mo, V, and Nb present in the alloy. Such limitations are not disclosed in the prior art disclosure. Since the prior art applied by the Office does not disclose the limitations of present Claims 2 and 11 the claims should not be obvious in view of the applied art and the rejections should be reversed.

Claims 3 and 12 further limit the alloy composition with regards to the content of Mn, Si, Cr, Cu, Mo, V, and Nb where the sum of the concentrations of these elements must be  $< 0.3\%$ . None of the prior art references cited by the Office limit the elements as recited in present Claims 3 and 12 in this manner. The further limitation of the elements provided in

Claims 3 and 12 is therefore not obvious in view of the prior art references and the rejections of Claims 3 and 12 should be reversed.

Claims 4 and 13 limit the concentration of main group materials such as oxygen, nitrogen and phosphorous in the claimed alloy. Such further limitations of the alloy compositions are not disclosed in the Ishikawa, Fukuda or Kato prior art references cited by the Office. The rejection of Claims 4 and 13 in view of the aforementioned prior art should therefore be reversed.

B. The subject matter of Claims 1-18 was described in the specification in such a way as to permit one to make and/or use the invention within the meaning of 35 U.S.C. § 112, first paragraph.

In the Office Action of September 23, 2002, the Office asserted that Claims 1-19 contain subject matter which was not described in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification as originally filed discloses that in order to reduce image defects caused by local heating in shadow masks, an average coefficient of expansion that is as low as possible between 20°C and 100°C and a mean coefficient of thermal expansion between 80°C and 130°C that is as low as possible is necessary. Further, the micrographic structure (i.e., microstructure) should be stable down to at least -50°C (see paragraph bridging pages 3 and 4 of the present specification). The composition of the alloy with regards to its cobalt and nickel content is believed to allow the mean coefficient of thermal expansion to be less than  $0.7 \times 10^{-6}/^{\circ}\text{K}$  when the cobalt and nickel contents adhere to the limitations of the present independent claims (see last paragraph on page 4). Therefore, in order to achieve a low coefficient of thermal expansion and a low martensitic transformation start point an alloy that contains both cobalt and nickel must meet the interrelationship requirements in the

independent claims where the both cobalt and nickel are recited. Further restrictions are placed upon other elements such as silicon, chromium and carbon in order to maintain the low coefficient of expansion and low martensitic transformation start point (page 5, lines 5-9).

The specification as originally filed describes four alloys Samples A, B, C and D in the Examples on pages 6 and 7. At least three of the Examples (Samples B, C and D) describe alloy compositions wherein a martensitic transformation start point of "< -186" °C is disclosed. A mean coefficient of expansion between 20°C and 100°C of  $< 0.7 \times 10^{-6}/^{\circ}\text{K}$  is disclosed on page 5, line 7 and a mean coefficient of expansion of  $0.49 \times 10^{-6}/^{\circ}\text{K}$  is disclosed for Example C on page 7. Therefore, the specification as originally filed fully supports the claim limitations in the independent claims wherein the martensitic transformation start point is limited to less than -50°C (independent Claims 1 and 7-8) or < -186°C (independent Claims 9, 16 and 18).

As noted above, the specification as originally filed describes alloy compositions meeting the requirements recited in the present independent claims. Further, the Office has stated:

"it is unclear why the examples (A to D) in pages 6-7 of the instant specification have different martensitic transformation start points and thermal coefficients of expansion since compositions of all examples are in the claimed ranges and also complied with the claimed equations. There is no teaching to obtain the martensitic transformation start points < -186 and/or thermal coefficients of expansion  $0.49 \times 10^{-6}$  to  $0.7 \times 10^{-6}$ ." (Office Action of September 23, 2002; page 2, paragraph no. 3).

Nowhere in the patent statute or administrative procedures of the U.S. Patent and Trademark Office is it a requirement that Inventors provide a description of why or how a claimed invention works. The specification need only to provide a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same," (35 U.S.C. § 112, first paragraph).

The specification as originally filed describes maintaining the cobalt and nickel contents of the alloy composition within certain ranges together with limitations on the contents of other elements (i.e., a way to carry out the invention). The compositional and physical property limitations provided in the present independent claims are unique characteristics which define the claimed alloy compositions and provide those of ordinary skill in the art the guideposts necessary to reproduce the claimed alloy compositions. Therefore, the rejection of Claims 1-19 under 35 U.S.C. § 112, first paragraph should be reversed.

C. Indefiniteness of Claims 1, 7 and 8 within the meaning of 35 U.S.C. § 112, second paragraph.

The Office rejected Claims 1-8 under 35 U.S.C. § 112, second paragraph noting that the limitations in independent Claims 1 and 7-8 (which provide two coefficients of thermal expansion) are indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. It appears that the Office has asserted that a coefficient of thermal expansion measured between 20 and 100°C and between 80 and 130°C is overlapping limitation (e.g., a narrow range falling within a broad range). This is manifestly incorrect. An average coefficient of thermal expansion between two temperature limits is an average of the coefficient of thermal expansions measured between those temperature limits, similar to the way a volatile liquid may have different boiling temperatures between different pressure ranges. The Office has provided no reason why such a measurement is indefinite. Further, the Office has provided no evidence that an alloy cannot have different average coefficient of thermal expansions for different temperature ranges. Although the presently claimed limitations contain average and mean coefficient of thermal expansions measured between overlapping temperature ranges, this is not indefinite because those of ordinary skill in the art

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are provided with the upper and lower limits between which the average and mean coefficient of thermal expansions must be measured. It is irrelevant that the ranges overlap and such is not indicative of indefiniteness. For these reasons the rejection of Claims 1-8 under 35 U.S.C. § 112, second paragraph should be reversed.

For these reasons the rejections of the present claims should be reversed.

Respectfully submitted,

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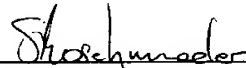
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APPENDIX I: CLAIMS

Claim 1. An Fe-Ni-Co alloy whose chemical composition comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}$  and  $130^{\circ}\text{C}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

Claim 2. The alloy as claimed in claim 1, wherein copper, molybdenum, vanadium and niobium contents are each present in less than 0.1%.

Claim 3. The alloy as claimed in claim 2, wherein the sum of the weight percentages of manganese, silicon, chromium, copper, molybdenum, vanadium and niobium is less than 0.3%.

Claim 4. The alloy as claimed in claim 1, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 5. The alloy as claimed in claim 2, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 6. The alloy as claimed in claim 3, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 7. A shadow mask, which comprises at least one foil having holes, said foil comprising an alloy whose chemical composition comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}$  and  $130^{\circ}\text{C}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

Claim 8. A method of forming a shadow mask, comprising the steps of forming holes in a foil and drawing said hole-containing foil, wherein the foil comprises an alloy having a chemical composition which comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$



$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}$  and  $130^{\circ}\text{C}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

Claim 9. An Fe-Ni-Co alloy consisting essentially of iron and:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

wherein % is % by weight, and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-186^{\circ}\text{C}$  and an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of from  $0.7 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ .

Claim 10. The alloy as claimed in Claim 9, wherein the average coefficient of thermal expansion is from  $0.65 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ .

Claim 11. The alloy as claimed in Claim 9, wherein copper, molybdenum, vanadium and niobium are each present in amounts less than 0.1%.

Claim 12. The alloy as claimed in Claim 11, wherein the sum of the weight percentages of manganese, silicon, chromium, copper, molybdenum, vanadium and niobium is less than 0.3%.

Claim 13. The alloy as claimed in Claim 9, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 14. The alloy as claimed in Claim 11, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 15. The alloy as claimed in Claim 12, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 16. A shadow mask, which comprises at least one foil having holes, said foil comprising an alloy, said alloy consisting essentially of iron and

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

wherein % is % by weight, and

$$S \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-186^{\circ}\text{C}$  and an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of from  $0.7 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ .

Claim 17. The shadow mask of Claim 16, wherein the average coefficient of thermal expansion is from  $0.65 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ .

Claim 18. A method of forming a shadow mask, comprising  
forming holes in a foil and  
drawing said hole-containing foil,  
wherein said foil comprises an alloy consisting essentially of iron and

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$S \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

wherein % is % by weight, and

$$S \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-186^{\circ}\text{C}$  and an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of from  $0.7 \times 10^{-6}/\text{K}$  to  $0.49 \times 10^{-6}/\text{K}$ .

APPENDIX II: RELATED APPEALS

Copies of the Appeal Brief, Examiner's Answer, Reply Brief and Decision on Appeal from parent application U.S. Application Serial No. 08/641,233 filed on April 30, 1996, now abandoned, are attached.

APPEAL BRIEF

DOCKET NO. 4101-130-55X

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: :  
Ricardo COZAR et al. : GROUP ART UNIT: 1308  
SERIAL NUMBER: 08/641,233 : EXAMINER: IP  
FILED: April 30, 1996 :  
FOR: FE-CO-NI ALLOY AND USE FOR THE :  
MANUFACTURE OF A SHADOW MASK

APPEAL BRIEF

Assistant Commissioner for Patents  
Washington, D.C. 20231

SIR:

Appellants hereby appeal Claims 1-8, 12 and 13.

I. REAL PARTY IN INTEREST

The real party in interest herein is Imphy, S.A., France.

II. RELATED APPEALS AND INTERFERENCES

To the best of Appellants' knowledge there is no appeal or interference which will directly affect or be directly affected by or have a bearing on the Board's decision in this case.

III. STATUS OF CLAIMS

Claims 1-8, 12 and 13 are pending and are appealed. Claims 9-11 have been cancelled.



#### IV. STATUS OF AMENDMENTS

The Advisory Action of July 14, 1997, indicates that the after-final amendment of July 3, 1997, will be entered upon the filing of the present appeal.

#### V. SUMMARY OF INVENTION

The present inventors have discovered an iron-nickel-cobalt alloy containing 32-34% nickel and 3.5-6.5% cobalt which provides physical characteristics that avoid the common problems which occur in iron-based shadow masks. See specification page 2, line 4 - page 3, line 18 and page 3, line 23 - page 4, line 16. A shadow mask foil comprising the invention alloy also makes up a part of the invention, as does a method of forming a shadow mask using the invention alloy. See specification page 7, lines 7-14.

#### VI. ISSUES

1. Whether Claims 1-6 are unpatentable under 35 U.S.C. §103 over JP 4-224,631 (Japan '631) or JP 04-221,021 (Japan '021).
2. Whether Claims 1-8 and 12-13 are unpatentable under 35 U.S.C. §103 over Inoue in view of Fukuda or Ishikawa or Kato.

#### VII. GROUPING OF CLAIMS

The claims are grouped individually and, for each ground of rejection contested herein and which applies to a group of two or more claims, the claims of the group do not stand or fall together. In the argument section provided below Appellant explains why the claims of the group are separately patentable.

## VIII. ARGUMENT

The present invention relates to an iron-nickel-cobalt alloy having particular amounts of nickel, cobalt, manganese, silicon, chromium, carbon, sulfur, calcium and magnesium, further satisfying several different inequalities which define the relationship of cobalt to nickel, and further providing several physical characteristics including a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$ , and a mean coefficient of thermal expansion between  $80^{\circ}\text{C}$  and  $130$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ . This alloy provides excellent shadow masks for cathode ray display tubes because it avoids the permanent deformations and local doming encountered with prior art shadow masks.

As explained at specification pages 1 and 2, iron-nickel-cobalt alloys are known and have been used in the formation of shadow masks. The physical characteristics of such alloys, however, are poor, and do not avoid permanent deformation or reduce the effect of local doming. Appellants have solve this problem by discovering an alloy which, when properly formulated, provides the claimed physical characteristics and possesses, inherently, the requisite properties to solve the problems encountered with prior art alloys.

Japan '631 and Japan '021 describe, very broadly, iron-nickel-cobalt alloys. The description in these references is no closer to the claimed subject matter than the description of the prior art found at specification pages 1 and 2. Nowhere are the particular limits for claimed elements disclosed in the references, nor are the three claimed relationships between nickel and cobalt, all of which must be met, to provide an alloy of Claim 1.

The Examiner has taken the position that a broad disclosure of iron-nickel-cobalt alloys is sufficient to render the present claims unobvious. Appellants strongly disagree.

Neither the element ranges, cobalt/nickel relationships, nor physical characteristics presently claimed are disclosed or suggested by the Japanese references, nor has it been shown that the references inherently provide or meet such requirements. Appellants have found, by the particular combination of limitations described in Claim 1, that prior art problems found in shadow masks are overcome with their alloy. Appellants filed data and a Declaration explaining this data showing that the unique characteristics which describe and define Appellants' alloy, when taken as a whole, yield an alloy superior to similar materials falling outside the presently claimed limits and relationships. Neither of the Japanese references would lead one of ordinary skill in the art to the alloy as presently claimed in Claim 1, and for this reason the references are insufficient to render this claim obvious. For these reasons the rejection of Claims 1-6 under 35 U.S.C. §103 over the two Japanese references should be REVERSED.

Inoue relates to an iron-nickel alloy sheet useful for forming a shadow mask which does not contain cobalt. The present claims require a relationship between nickel and cobalt such that the sum of nickel and cobalt is less than or equal to 38.5%, the sum of cobalt and one half the nickel content is greater than or equal to 20%, and the sum of cobalt and five times the nickel content is greater than or equal to 165.5%. Appellants have submitted a Declaration in which Figure 1 attached thereto shows that the first relationship mentioned (the sum of cobalt and nickel being less than or equal to 38.5%) provides a thermal expansion coefficient between 20° and 100° of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$ , and where Figures 2 and 3 show that the second and third cobalt-nickel relationships referred to above provide the claimed thermal expansion coefficient between 80°C and 130° and Ms point. How can Inoue, as a primary reference, be used to reject the pending claims? Inoue has no cobalt

whatsoever. How could one take the position that a secondary reference, even one which shows an iron-nickel-cobalt alloy, be used to modify Inoue such that the presently claimed limitations could be reached? Clearly, either the secondary references applied are sufficient on their own to reject the claims, or the present rejection which combines Inoue with the secondary references is clearly and facially insufficient.

Fukuda, one secondary reference combined with Inoue, indeed relates to an iron-nickel-cobalt alloy for a shadow mask but does not suggest the presently claimed nickel or cobalt limits and further fails to suggest the cobalt nickel relationship as defined by Appellants' three claimed inequalities. Nothing in the reference suggests that when the nickel-cobalt relationship is as claimed herein that the physical characteristics presently claimed result and, as such that the prior art difficulties obtained with shadow masks are avoided. The only relevant example in Fukuda (Example 8 - Table 1, Table 2) has a thermal expansion coefficient which is much greater than that claimed for the temperature range of from 20-100°C, and higher than that claimed for the temperature range of from 80-130°C herein. Kato is similar, and says nothing about the Ms point, the particular claimed relationships between nickel and cobalt, and further provides a thermal expansion coefficient always higher than  $1 \times 10^{-6}/^{\circ}\text{K}$  (see Table 3 therein).

Finally, Ishikawa relates to an alloy that is not suggested for use as a shadow mask and which adjusts Ms point with the addition of carbon in view of the nickel content. In the present invention, as shown by the Declaration submitted herein, Ms point is adjusted by choosing a nickel and cobalt content such that the sum of cobalt and five times the nickel content is greater than 165.5%. Since this relationship, in addition to the other cobalt-nickel relationships claimed, is lacking and further in view of the fact that the basic element

limitations claimed are not disclosed in the reference Appellants submit that this reference is insufficient on its own, or combined with Inoue, to properly reject the pending claims. This is particularly true with regard to those claims which require or make a shadow mask since the reference does not relate to such structures. While the Examiner has indicated in the Advisory Action that Ishikawa discloses thermal expansion coefficients as claimed, such is not the case. The Ishikawa thermal expansion coefficients are given between 0 and 100°C or between -20 and 120°C. In the present invention Appellants have simultaneously adjusted the mean thermal expansion coefficients between 20°C and 100°C, and between 80°C and 130°C. This point is very important because the variation of thermal expansion coefficient with temperature is not linear, and depends upon chemical composition. In this way, Appellants have solved the problems of the prior art and provided an alloy which is useful in the formation of a shadow mask which addresses the problems encountered with the prior art and which reduces the defects of local doming and permanent deformation. In no way do the combination of references cited against the claims disclose or suggest the claims, and thus the rejection fails to present a *prima facie* case.

The above remarks apply generally to all pending claims and, where appropriate, it has been pointed out that an applied reference which does not disclose a shadow mask has been improperly applied against Claim 7, directed to a shadow mask, and/or against Claim 8, directed to a method of forming a shadow mask. The dependent claims appealed herein all further specify the chemical composition described in the independent claims from which they depend, and by this more specific definition, further distinguish the claimed subject matter from the references applied. Nothing in any of the references thus would suggest, describe or motivate one of ordinary skill in the art to provide what is claimed herein, and for

these additional reasons the outstanding rejections should be REVERSED.

Respectfully submitted,

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(OSMMN 10/95)

## APPENDIX

1. An Fe-Ni-Co alloy whose chemical composition comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}\text{C}$  and  $130^{\circ}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

2. The alloy as claimed in claim 1, wherein copper, molybdenum, vanadium and

niobium contents are each present in less than 0.1%.

3. The alloy as claimed in claim 2, wherein the sum of the weight percentages of manganese, silicon, chromium, copper, molybdenum, vanadium and niobium is less than 0.3%.

4. The alloy as claimed in claim 1, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

5. The alloy as claimed in claim 2, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

6. The alloy as claimed in claim 3, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

7. A shadow mask, which comprises at least one foil having holes, said foil comprising an alloy whose chemical composition comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$



and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy further satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}\text{C}$  and  $130^{\circ}\text{C}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

8. A method of forming a shadow mask, comprising the steps of forming holes in a foil and drawing said hole-containing foil, wherein the foil comprises an alloy having a chemical composition which comprises, by weight based on total weight:

$$32\% \leq \text{Ni} \leq 34\%$$

$$3.5\% \leq \text{Co} \leq 6.5\%$$

$$0\% \leq \text{Mn} \leq 0.1\%$$

$$0\% \leq \text{Si} \leq 0.1\%$$

$$0\% \leq \text{Cr} \leq 0.1\%$$

$$0.005\% \leq \text{C} \leq 0.02\%$$

$$\text{S} \leq 0.001\%$$

$$0.0001\% \leq \text{Ca} \leq 0.002\%$$

$$0.0001\% \leq \text{Mg} \leq 0.002\%$$

and further comprising iron and impurities resulting from smelting; the chemical composition

of the alloy further satisfying the relationships:

$$\text{Co} + \text{Ni} \leq 38.5\%$$

$$\text{Co} + 0.5 \times \text{Ni} \geq 20\%$$

$$\text{Co} + 5 \times \text{Ni} \geq 165.5\%$$

and

$$\text{S} \leq 0.02 \times \text{Mn} + 0.08 \times \text{Ca} + 0.6 \times \text{Mg}$$

wherein said alloy has a martensitic transformation start point of less than  $-50^{\circ}\text{C}$ , an average coefficient of thermal expansion between  $20^{\circ}$  and  $100^{\circ}\text{C}$  of less than or equal to  $0.7 \times 10^{-6}/^{\circ}\text{K}$  and a mean coefficient of thermal expansion between  $80^{\circ}\text{C}$  and  $130^{\circ}\text{C}$  of less than or equal to  $1 \times 10^{-6}/^{\circ}\text{K}$ .

12. The mask as claimed in Claim 7, wherein said foil having holes is provided with said holes by drilling.

13. The method as claimed in Claim 8, wherein said step of forming holes in a foil is accomplished by drilling holes in a foil.